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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/607,912	06/27/2003	Andre Bernard	BREV 13186 DIV	8153

7590

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EXAMINER

MARKHAM, WESLEY D

ART UNIT

PAPER NUMBER

1762

DATE MAILED: 04/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/607,912	<b>Applicant(s)</b> BERNARD ET AL.	
	<b>Examiner</b> Wesley D Markham	<b>Art Unit</b> 1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 11-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 June 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☒ Certified copies of the priority documents have been received in Application No. 09/830,380.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |                                                                                                    |                                                                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. ____                                                 |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>2 total</u> .                                                             | 6) <input type="checkbox"/> Other: ____                                     |

TS

## DETAILED ACTION

### *Response to Amendment*

1. Acknowledgement is made of the preliminary amendment filed by the applicant on 6/27/2003, in which the specification of the instant application was amended (e.g., to correct various informalities and to insert the appropriate continuity data), a new abstract of the disclosure was submitted, Claims 1 – 10 were canceled, Claims 11 – 13 were amended, and Claims 14 – 25 were added. **Claims 11 – 25** are currently pending in U.S. Application Serial No. 10/607,912, which is a divisional of 09/830,380, which is a 371 of PCT/FR99/02797. An Office Action on the merits follows.

### *Priority*

2. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy of FR 98/14350 (filing date of 11/16/1998) has been filed in parent Application No. 09/830,380, filed on 4/25/2001. Additionally, the examiner notes that a certified English language translation of the aforementioned French priority document has been submitted in the parent application, and the priority document fully supports the subject matter of Claims 11 – 25 of the instant application.

***Information Disclosure Statement***

3. The IDSs filed by the applicant on 6/27/2003 and 4/9/2004 are acknowledged by the examiner, and the references listed thereon have been considered as indicated on the attached copies of the PTO-1449 and 892 forms.

***Drawings***

4. The formal drawings (3 sheets, 8 figures) filed by the applicant on 6/27/2003 are acknowledged and approved by the examiner.

***Claim Objections***

5. Claim 18 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Specifically, Claim 18 recites, "said at least one layer of hafnium oxide is deposited under vacuum by reactive evaporation under oxygen of metallic hafnium". However, independent Claim 11 (from which Claim 18 depends) already requires such a limitation. As such, Claim 18 does not further limit Claim 11.

***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 11 – 25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
8. Regarding independent **Claim 11**, the claim appears to be a “process” claim. However, there are no active steps recited in the claim. The absence of any “process” steps in such a process claim renders the scope of Claim 11, as well as **Claims 12 – 22** (which depend from Claim 11), unclear. Specifically, Claim 11 appears to be drawn to a process for vacuum deposit on a substrate of at least one layer of amorphous hafnium oxide by reactive evaporation of metallic hafnium under oxygen, the process characterized in that the deposit is carried out without energy input to the substrate; however, the claim does not set forth what process steps are required “for vacuum deposit” in the manner claimed by the applicant, thereby rendering the claims vague and indefinite. Please note that Claims 23 – 25 have not been rejected on these grounds because the claims require the active step of “vacuum depositing on a substrate at least one layer of amorphous hafnium oxide...”
9. Additionally, **Claim 11** (from which **Claims 12 – 25** depend) requires, in part, that the deposit be carried out “without energy input to the substrate”. This limitation renders the claims vague and indefinite (i.e., renders the scope of the claims unclear) because one skilled in the art would not be reasonably apprised of the metes and bounds of the claims (i.e., would not be reasonably apprised of what vacuum

deposition processes input energy to the substrate, and which processes do not, in the context of the claimed invention). For example, it is clear from the applicant's specification that actively heating and/or ion bombarding the substrate are processes that input energy to the substrate (see page 1, line 23 – page 2, line 4; page 8, lines 13 – 19; and page 10, lines 14 – 18 of the specification) and thus, are excluded from the claimed amorphous hafnium oxide deposition process. However, it is also clear from the applicant's specification that, under at least some circumstances, a substrate temperature rise occurs (presumably due to inadvertent heating) during the claimed process (page 13, lines 17 – 30, and Claims 12 and 13). As such, there is some “energy input” to the substrate in the applicant's claimed process. Therefore, one skilled in the art would not be reasonably apprised of how much “energy input” (e.g., how much temperature rise) is permitted by the applicant's claimed process, and how much “energy input” is excluded from the claimed process (e.g., how much of a temperature rise is permitted before the applicant considers the process to comprise “energy input to the substrate”?).

### ***Claim Rejections - 35 USC § 102***

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claims 11, 14, 15, 18, 23, and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Chow et al. ("Reactive evaporation of low-defect density hafnia", 1993).
12. Regarding independent **Claim 11 and Claim 18**, Chow et al. teaches a process comprising vacuum depositing at least one layer of hafnium oxide on a substrate by reactive evaporation (e.g., electron beam evaporation) of metallic hafnium under oxygen (Abstract, pages 5567 – 5569, 5571 – 5572, and Figures 6 and 7, which show the results from processes in which metallic Hf sources are used in combination with molecular O<sub>2</sub> in the vacuum deposition process). Additionally, in the processes in which molecular O<sub>2</sub> (not O<sub>2</sub> plasma) is used, there is no ion bombardment of the substrate during the hafnium oxide deposition, and the substrates are only unintentionally heated (page 5569, col.1). The examiner has reasonably interpreted such a process to be "carried out without energy input to the substrate", as claimed by the applicant. Additionally, Chow et al. does not explicitly teach that the hafnium oxide layer is "amorphous". However, the process of Chow et al. appears to be identical to the applicant's claimed process (i.e., both processes comprise evaporating metallic hafnium, under oxygen, in a vacuum with an electron beam without intentionally heating the substrate and without bombarding the substrate with any particles (e.g., ions, radicals, plasma, etc.) during the deposition). Therefore, the layer of hafnium oxide deposited in the examples taught by Chow et al. would have inherently been "amorphous" unless essential process steps and/or limitations are missing from the applicant's claims. Regarding **Claim 23**, Chow et al.

also teaches forming an optical component by vacuum depositing at least one layer of amorphous hafnium oxide by the process of Claim 11 (Abstract, pages 5567 – 5569, 5571 – 5572, and Figures 6 and 7, as well as the discussion of Claim 11 above). Regarding **Claims 14, 15, and 24**, Chow et al. does not explicitly teach that the layer(s) of hafnium oxide has a density lower than  $8 \text{ gm/cm}^3$ , particularly between  $6.4$  and  $8.1 \text{ gm/cm}^3$ . Specifically, Chow et al. is silent regarding the density of the hafnium oxide layer. However, as discussed above, the process of Chow et al. appears to be identical to the applicant's claimed process (i.e., both processes comprise evaporating metallic hafnium, under oxygen, in a vacuum with an electron beam without intentionally heating the substrate and without bombarding the substrate with any particles (e.g., ions, radicals, plasma, etc.) during the deposition). Since the processes are the same, and the density of a deposited oxide film having a specific composition (i.e., hafnium oxide) is simply a function of the process used to deposit the film, the density of the hafnium oxide film of Chow et al. would have inherently been the same as the density of the hafnium oxide film produced by the applicant's claimed process (e.g., between  $6.4$  and  $8.1 \text{ gm/cm}^3$ ).

### ***Claim Rejections - 35 USC § 103***

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).
15. Claims 11 – 19, 21, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kihara et al. (JP 60-64326 A) in view of Chow et al.
16. Regarding independent **Claim 11, Claim 18, and Claim 23**, Kihara et al. teaches a process of making a solid-state electrochromic element (i.e., an “optical device”), the process comprising depositing at least one layer of amorphous hafnium oxide on a substrate by electron beam evaporation (i.e., “reactive evaporation”) of a metal oxide ( $\text{Hf}_2\text{O}_3$ ) source (Abstract) The hafnium oxide evaporation / deposition process is carried-out in a water vapor atmosphere (Abstract), which the examiner has reasonably interpreted to be “under oxygen”, as water vapor comprises oxygen. Additionally, Kihara et al. does not teach or suggest heating the substrate or actively “imparting energy” to the substrate during the amorphous hafnium oxide deposition process. As such, it would have been obvious to one of ordinary skill in the art to perform the process of Kihara et al. “without energy input to the substrate” (i.e.,

because it does not appear that any "energy input" is required by Kihara et al., and a process that does not actively input energy (e.g., heat, bombard) to the substrate would be expected to advantageously be simpler and less expensive). Kihara et al. does not explicitly teach that the evaporated source material is metallic hafnium. However, Chow et al. teaches that, in the art of vacuum depositing a hafnium oxide film on a substrate in an oxygen-containing ambient (i.e., a process analogous to that of Kihara et al.), the hafnium oxide coatings can be deposited by electron beam evaporating a metallic hafnium source as opposed to a conventional hafnia source (Abstract, page 5569, Figures 6 and 7). The hafnium oxide coatings made from the hafnium sources have lower nodular-defect densities and lower absorption than the coatings made from a conventional hafnia (hafnium oxide) source (Abstract). Therefore, it would have been obvious to one of ordinary skill in the art to vacuum evaporate a metallic hafnium source (as opposed to a hafnia source) in the process of Kihara et al. with the reasonable expectation of (1) success, as Chow et al. teaches that both metallic hafnium and hafnia sources, evaporated in the presence of oxygen, produce hafnium oxide coatings (as desired by Kihara et al.), and (2) obtaining the benefits of using a metallic hafnium source, such as producing a coating that has lower nodular-defect density and lower absorption. At the very least, one of ordinary skill in the art would have reasonably expected to obtain similar successful results (i.e., the deposition of an amorphous hafnium oxide layer), regardless of whether metallic hafnium or hafnia was used as the source material. Regarding **Claims 12 and 13**, the combination of Kihara et al. and Chow et al. does

not explicitly teach interrupting and then restarting the deposit to allow the substrate to cool, or that the substrate is cooled during deposit or during periods of interruption of deposit. However, the process of Kihara et al. involves depositing a plurality of different metal oxide layers prior to depositing the amorphous hafnium oxide layer (e.g., indium oxide transparent electrode "2" and tungsten oxide electrochromic layer "3") and depositing another electrode layer "5" after depositing the hafnium oxide layer (Abstract). As such, the deposition of Kihara et al. is "interrupted", as required by the claims, and it is the examiner's position that at least some degree of substrate cooling would occur during the interruption of the deposit because the unintentional heating of the substrate due to the electron beam heating / evaporation of the source material would not occur during the period(s) of interruption (i.e., before and after depositing each layer, including the hafnium oxide layer). Regarding **Claims 14, 15, and 24**, the combination of Kihara et al. and Chow et al. does not explicitly teach that the amorphous layer of hafnium oxide has a density lower than  $8 \text{ gm/cm}^3$ , particularly between  $6.4$  and  $8.1 \text{ gm/cm}^3$ . Specifically, Kihara et al. is silent regarding the density of the hafnium oxide layer. However, the process reasonably suggested by the combination of Kihara et al. and Chow et al. appears to be identical to the applicant's claimed process (i.e., both processes comprise evaporating metallic hafnium, under an oxygen ambient, in a vacuum with an electron beam without intentionally heating the substrate and without bombarding the substrate with any particles (e.g., ions, radicals, plasma, etc.) during the deposition). Since the processes are the same, and the density of a deposited oxide film having a specific

composition (i.e., hafnium oxide) is simply a function of the process used to deposit the film, the density of the hafnium oxide film of the combination of Kihara et al. and Chow et al. would have inherently been the same as the density of the hafnium oxide film produced by the applicant's claimed process (e.g., between 6.4 and 8.1 gm/cm<sup>3</sup>). Regarding **Claims 16, 17, 19, and 21**, the process of Kihara et al. involves depositing a plurality of different metal oxide layers prior to depositing the amorphous hafnium oxide layer (e.g., indium oxide transparent electrode "2" and tungsten oxide electrochromic layer "3") and depositing another electrode layer "5" after depositing the hafnium oxide layer (Abstract), which is equivalent to forming a stack of layers, at least one layer formed of a material having a refractive index different from that of hafnium oxide (e.g., indium oxide or tungsten oxide), the stack comprising at least one layer of another material formed on the surface of the amorphous hafnium oxide layer / alternating layers of amorphous hafnium oxide and another material. Regarding the hafnium oxide density limitation in Claim 21, see the discussion of Claims 14, 15, and 24 above.

17. Claims 14, 15, 21, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kihara et al. (JP 60-64326 A) in view of Chow et al., in further view of Waldorf et al. ("Optical coatings deposited by reactive ion plating", 1993).
18. As an alternative to the reasoning presented above, the combination of Kihara et al. and Chow et al. teaches all the limitations of **Claims 14, 15, 21, and 24** as set forth above in paragraph 16, except for a method wherein the amorphous hafnium oxide

layer (in the stack) has a density lower than  $8 \text{ gm/cm}^3$ , particularly between  $6.4$  and  $8.1 \text{ gm/cm}^3$ . Specifically, Kihara et al. is silent regarding the density of the hafnium oxide layer, but is drawn to depositing an amorphous hafnium oxide layer in general. Waldorf et al. teaches that, in the art of electron beam evaporation / deposition of oxide coatings such as hafnium oxide, the film porosity (i.e., the density) can be modified by controlling process parameters such as substrate temperature (Abstract, page 5583, col.2). In other words, the density of an electron beam evaporated / deposited oxide film is a result / effective variable that is determined by process parameters such as the substrate temperature. Therefore, it would have been obvious to one of ordinary skill in the art to optimize the density of the amorphous hafnium oxide film of Kihara et al. as a result / effective variable through routine experimentation by appropriately controlling process parameters such as substrate temperature.

19. Claims 11 – 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsujimura et al. (USPN 5,339,326) in view of Chow et al.

20. Regarding independent **Claim 11, Claim 18, and Claim 23**, Tsujimura et al. teaches a process for forming an optical component, specifically a reflector (i.e., a “mirror”) (Abstract), the process comprising vacuum depositing at least one layer of hafnium oxide on a substrate by electron beam evaporation of a hafnia target (Abstract, Col.1, lines 7 – 10, Col.2, lines 15 – 68, Col.3, lines 1 – 2, Col.4, lines 1 – 63, and Example 8). The process is carried out while keeping the substrate at a temperature

of, for example, 20° C and without bombarding the substrate with high energy particles (e.g., ions, plasma, etc.) (Col.2, lines 53 – 55, Col.4, lines 40 – 50, Col.10, lines 30 – 32). The examiner has reasonably interpreted such a process to be carried out “without energy input to the substrate”, as claimed by the applicant. Tsujimura et al. does not explicitly teach that the evaporated source material is metallic hafnium and the evaporation takes place under oxygen. However, Chow et al. teaches that, in the art of vacuum depositing a hafnium oxide film on a substrate (i.e., a process analogous to that of Tsujimura et al.), the hafnium oxide coatings can be deposited by electron beam evaporating a metallic hafnium source under oxygen as opposed to a conventional hafnia source (Abstract, page 5569, Figures 6 and 7). The hafnium oxide coatings made from the hafnium sources, evaporated under oxygen, have lower nodular-defect densities and lower absorption than the coatings made from a conventional hafnia (hafnium oxide) source (Abstract). Therefore, it would have been obvious to one of ordinary skill in the art to vacuum evaporate a metallic hafnium source (as opposed to a hafnia source) under oxygen in the process of Tsujimura et al. with the reasonable expectation of (1) success, as Chow et al. teaches that both metallic hafnium and hafnia sources, evaporated in the presence of oxygen, produce hafnium oxide coatings (as desired by Tsujimura et al.), and (2) obtaining the benefits of using a metallic hafnium source, such as producing a coating that has lower nodular-defect density and lower absorption. At the very least, one of ordinary skill in the art would have reasonably expected to obtain similar successful results (i.e., the deposition of a hafnium oxide layer),

regardless of whether metallic hafnium or hafnia was used as the source material. Additionally, Tsujimura et al. does not explicitly teach that the hafnium oxide layer is "amorphous". However, the combination of Tsujimura et al. and Chow et al. reasonably suggests depositing the hafnium oxide layer or layers in the manner claimed by the applicant (i.e., by evaporating metallic hafnium under oxygen and depositing the film at a low substrate temperature). As such, the hafnium oxide film(s) deposited by the combination of Tsujimura et al. and Chow et al. would have inherently been "amorphous" (e.g., due to the low temperature of, or lack of "energy input" to, the substrate). Regarding **Claims 12 and 13**, the combination of Tsujimura et al. and Chow et al. does not explicitly teach interrupting and then restarting the deposit to allow the substrate to cool, or that the substrate is cooled during deposit or during periods of interruption of deposit. However, the process of Tsujimura et al. involves depositing a plurality of alternating layers of a low refractive index material (e.g., SiO<sub>2</sub>, etc.) and a high refractive index material such as hafnium oxide (Col.2, lines 15 – 63, Col.4, lines 1 – 45, and Example 8) As such, the deposition of Tsujimura et al. is "interrupted", as required by the claims, and it is the examiner's position that at least some degree of substrate cooling would occur during the interruption of the deposit because the unintentional heating of the substrate due to the electron beam heating / evaporation of the source material would not occur during the period(s) of interruption (i.e., before and after depositing each layer, including the hafnium oxide layer(s)). Tsujimura et al.'s teaching that the substrate is maintained at a low temperature throughout the process supports the examiner's

position. Regarding **Claims 14, 15, and 24**, the combination of Tsujimura et al. and Chow et al. does not explicitly teach that the amorphous layer of hafnium oxide has a density lower than  $8 \text{ gm/cm}^3$ , particularly between  $6.4$  and  $8.1 \text{ gm/cm}^3$ .

Specifically, Tsujimura et al. is silent regarding the density of the hafnium oxide layer(s). However, the process reasonably suggested by the combination of Tsujimura et al. and Chow et al. appears to be identical to the applicant's claimed process (i.e., both processes comprise evaporating metallic hafnium, under an oxygen ambient, in a vacuum with an electron beam while keeping the substrate temperature low during the deposition). Since the processes are the same, and the density of a deposited oxide film having a specific composition (i.e., hafnium oxide) is simply a function of the process used to deposit the film, the density of the hafnium oxide film of the combination of Tsujimura et al. and Chow et al. would have inherently been the same as the density of the hafnium oxide film produced by the applicant's claimed process (e.g., between  $6.4$  and  $8.1 \text{ gm/cm}^3$ ). Regarding **Claims 16, 17, 19 – 22, and 25**, Tsujimura et al. also teaches forming a stack of layers, specifically alternating layers of a material having a refractive index different from that of hafnium oxide, such as silicon oxide, and hafnium oxide, the stack of layers forming a reflector (i.e., a "mirror") (Col.1, lines 7 – 10, Col.2, lines 15 – 63, Col.4, lines 1 – 45, and Example 8). Regarding the hafnium oxide density limitation in Claim 21, see the discussion of Claims 14, 15, and 24 above.

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21. Claims 14, 15, 21, 22, 24, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsujimura et al. in view of Chow et al., in further view of Waldorf et al. ("Optical coatings deposited by reactive ion plating", 1993).
22. As an alternative to the reasoning presented above, the combination of Tsujimura et al. and Chow et al. teaches all the limitations of **Claims 14, 15, 21, 22, 24, and 25** as set forth above in paragraph 20, except for a method wherein the amorphous hafnium oxide layer (in the stack) has a density lower than  $8 \text{ gm/cm}^3$ , particularly between  $6.4$  and  $8.1 \text{ gm/cm}^3$ . Specifically, Tsujimura et al. is silent regarding the density of the hafnium oxide layer(s), but is drawn to depositing a hafnium oxide layer in general while keeping the substrate temperature low (e.g.,  $20^\circ \text{ C}$  to  $150^\circ \text{ C}$ ). Waldorf et al. teaches that, in the art of electron beam evaporation / deposition of oxide coatings such as hafnium oxide, the film porosity (i.e., the density) can be modified by controlling process parameters such as substrate temperature (Abstract, page 5583, col.2). In other words, the density of an electron beam evaporated / deposited oxide film is a result / effective variable that is determined by process parameters such as the substrate temperature. Therefore, it would have been obvious to one of ordinary skill in the art to optimize the density of the hafnium oxide film of Tsujimura et al. as a result / effective variable through routine experimentation by appropriately controlling process parameters such as substrate temperature.

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**Conclusion**

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Woodard et al. (USPN 5,494,743) teaches sputter-depositing a discontinuous metal (e.g., Hf) oxide antireflection coating on an optical device from a metal cathode in an oxygen gas-containing vacuum.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (571) 272-1422. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

WDM

WDM

TIMOTHY MEEKS  
PRIMARY EXAMINER

Wesley D Markham  
Examiner  
Art Unit 1762